An Examination of the Economic Effects of the Winter Olympics

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Abstract

The Olympic Games are one of the world's largest sporting events with millions travelling to watch them in person and tens of millions more watching on television. These staggering figures underlie the debate over the economic benefits of hosting the Games. Much research has been done on the effect of the Summer Olympics but little has been researched on the Winter Games. This paper tests the hypothesis that hosting a Winter Olympic Games yields long term economic benefits which would have otherwise not been realized. Variables examined include population growth, long term unemployment, and 4 year average GDP growth both pre and post Olympics for both host regions and their respective countries. The initial results proved inconclusive.

1. Introduction

The Olympic Games are one of the biggest and most highly watched sporting events in the world with thousands of athletes from nearly every country competing biannually. Hosting an Olympic Games is such a highly sought after honor, that cities expend significant amounts of money to simply enter a bid. Cities that win their bid for an Olympics then spend an extraordinary amount more building new stadiums, hotels, updating infrastructure, etc. For example, nearly $50 million was reportedly spent preparing Sochi for the 2014 Summer Olympics[1].

Whether the enormous expenditures associated with hosting a mega-event, such as the Olympics or the World Cup, result in economic growth that offsets those expenditures is a hotly debated topic. Proponents argue that hosting a mega-event creates jobs, increases tourism, and ultimately results in long term economic growth for the host city. They say that the new stadiums which are constructed help draw in other events, as well as create jobs in a variety of industries, including tourism and real estate. They further argue that the increased name recognition that results from hosting an event increases tourism to the city, resulting in a higher GDP. Conversely, opponents argue that any gains made from hosting one of these events are short lived and consistently fail to outweigh the associated expenditures.

The focus of this paper is to examine the effects of hosting a Winter Olympics on a variety of economic metrics. While abundant literature examining the economic effects of hosting a Summer Olympics or World Cup exists, there is a noticeable lack of research on the effects of the Winter Olympics. The Winter Olympics are distinguishable from the World Cup and Summer Olympics for a number of different reasons. First, the World Cup is a country wide event which, with a few exceptions, takes place in industrialized nations who have the appropriate infrastructure already in place, lowering expenditures. Examples include Germany, Japan, France, USA, etc. Conversely, while the Winter Olympics usually take place in industrialized countries, they are in lesser known cities such as Sochi, Torino, Salt Lake City, and Nagano. Prior to their hosting, these cities lacked the infrastructure to handle an event of that magnitude. With regard to the Summer Olympics, it is usually held in larger, more well known cities such as London, Beijing, Athens, and Sydney. Not only do these cities have to expend less money to host the Summer Games, they also receive little increase in name recognition given that they are already globally known cities.

With this information in consideration, we are going to test the hypothesis that hosting a Winter Olympics leads to positive economic effects that outweigh the initial expenditures required to host the Games. Should the hypothesis hold true, it would suggest that policymakers increase their efforts to

[1] http://www.businessinsider.com/why-sochi-is-by-far-the-most-expensive-olympics-ever-2014-1

secure Winter Olympics for their city. On the contrary, if the hypothesis is incorrect, then it would suggest that smaller cities should exercise restraint the next time their politicians seek to put a bid in on an Olympic Games.

2. Literature Review

There has been extensive research on the economic effects of a mega-event, such as the Summer Olympics, on the economic performance of its host city. While the studies conducted on the Summer Olympics covered a wide range of years and cities, the research on the Winter Olympics has been primarily consisted of individual case studies. Regardless of their scale, the results of these studies appear to be inconsistent, leaving open the debate over the value of hosting an Olympics.

A study on the Winter Olympics was performed by Koyo Miyoshi and Masaru Sasaki (2016) on the long term effects of the Games on Nagano's, as well as it surrounding towns and villages, GDP and labor market. Miyoshi and Sasaki examined multiple different sectors of the economy including real estate, construction, tourism, and hospitality with the goal of finding out how long the economic impact of the Olympic Games lasts. Their results showed that the per capita GDP of Nagano Prefecture (district of Nagano) was notably higher than their control prefectures for the entire ten years following the 1998 Olympics. Further, they showed that population of Nagano following the Games exceeded that of the control group. With regard to the construction industry, they found that while there was an increase in construction over the control leading up to the games, there was virtually zero difference post Olympics. In both the service and real estate industries, Miyoshi and Sasaki noted a significantly positive long term effect from the Olympics. They theorized that the influx of population into Nagano Prefecture drove up land prices, causing a real estate boom and resulting crash. This led to money making opportunities in the real estate industry. Finally, they concluded that there was no long term effect on labor market. Upon review of their research, Miyoshi and Sasaki found, with the exception of a couple of sectors, little long term economic benefit from the Olympics and suggested that Tokyo not go into too much debt preparing for the 2020 Olympic Games.

Stephen Billings and Scott Holladay (2012) examined data on Olympic host cities from 1956 through 2004 to determine what, if any, the long term economic effects hosting the Summer Olympics has on its host city. They compared the host city of each Summer Olympics to the other finalists for that same Olympics. For example, they compared Atlanta to its two competitors for the 1996 Games: Manchester and Belgrade. The reason for doing this was to eliminate what they perceived as self-selection bias in other studies. Self-selection bias can occur when someone or something selects itself into a group. The idea being that cities that select themselves to host an Olympics may have special characteristics that make them difficult to compare to other cities, even if they are in the same region. The results showed a number of interesting findings. First, population in host cities grew at a faster rate, and continues to grow at a faster rate, than the other finalists. They note however, that these findings may be misleading insofar as the population growth in more recent Olympic hosts is equal to or lower than their finalist counterparts. Next, they concluded that GDP growth for host cities was on par with the finalist cities implying that there is no benefit to GDP by hosting. Overall, their findings are inconclusive as to the long term benefits of hosting a Summer Olympics.

Darren McHugh (2006) took a different approach in his examination of the Olympic Games, opting for a cost-benefit analysis instead of a regression model. McHugh looked at a economic data from the 1988 Olympics in Calgary as well the plans set out by the Vancouver government to predict whether the 2010 Winter Olympics is a worthwhile endeavor for Vancouver. In his analysis, the focus was on infrastructure and tourism. Infrastructure was looked at in two different ways: updates that would have taken place regardless, and updates that were specifically undertaken for the Olympics. McHugh grouped the infrastructure projects into the broader categories of "in-person spectacle" and "televised spectacle." He found that the in person spectacle would yield a benefit to the city in the amount of $306 million. This was a result of ticket price, capacity, and average concessions revenue minus cost of construction and maintenance. The televised spectacle is simply the revenue generated from TV contracts that they negotiate with the IOC. Finally, McHugh found that tourism would result in $361 million for the city; however, he did note that this was dramatically lower than the proponents estimate. Overall, this cost-benefit analysis appears to be an oversimplification of the benefits of an Olympics since it only takes into account the very short term results and fails to address effect on GDP whatsoever.

As is shown in this review of relevant literature, there has been an unusually small amount of research done on the effects of the Winter Olympics on the economy of the host city. More specifically, there has not been any research done on the average effect of hosting a Winter Olympics on all host cities. Previous research has focused on individual case studies which may or may not be indicative of the overall effects. We feel that individual case studies are not an effective tool for policymakers to utilize when determining whether to bid on an Olympics due to the unique characteristics of each city. For example, there may be some factor which makes an Olympics profitable for one city but not for others or vice versa. We seek to determine to determine if hosting a Winter Olympics makes economic sense on the aggregate, not just for specific cities. There have been similar studies done across all Summer Olympic hosts, but we feel that the Winter Olympics and its host cities are distinguished enough to potentially lead to different a outcome than the Summer studies. To that end, this paper intends to examine all of the host cities since 1964, as well as finalist cities, and determine the effect, if any, that the Games had on their economies.

3. Data

Winter Olympic Games 1964 - 2014			
1964	Innsbruck, Austria	1992	Albertville, France
1968	Grenoble, France	1994	Lillehammer, Norway
1972	Sapporo, Japan	1998	Nagano, Japan
1976	Innsbruck, Austria	2002	Salt Lake City, United States
1980	Lake Placid, United States	2006	Turin, Italy
1984	Sarajevo, Yugoslavia*	2010	Vancouver, Canada
1988	Calgary, Canada	2014	Sochi, Russia**

*The 1984 Winter Games were omitted due to the breakup of Yugoslavia in the 1980s.
**The 2014 Winter Games were omitted due to conflict with our method of analysing GDP

Our research sets out to determine the economic benefits, if any there may be, realized from hosting a Winter Olympic games. We gathered data on every host and finalist dating back to 1964. Olympics prior to 1964 were excluded due to (1) a lack of data, and (2) to avoid economic impacts from wars, depressions, etc. Finalists were included to rule out self-selection bias as there may be some unique characteristics about those cities/countries that choose to submit a bid that are otherwise unable to be captured. With the exception of the United States and Canada, where data were collected at the state and territory level respectively, all data were collected at the country level. This was done for a couple of reasons: (1) the Winter Olympics tend to take place over a larger region than its summer counterpart, expanding the potential economic impact beyond the host city alone, (2) with few exceptions, the bidding cities tend to come from relatively small countries geographically meaning that the impact on one city/region is likely to have an impact nationwide, and (3) because Winter Olympic cities tend to be smaller and less well known those in the Summer Games, reliable data is difficult to come by.

Variables	
postGDP	The average GDP growth per capita of the four years after the Winter Olympic games were held (Includes the year it was held).
preGDP	The average GDP growth per capita of the four years prior to hosting the Winter Olympics.
govExp	The average government expenditure in the years leading up to the Winter Olympic Games.
host	A dummy variable consisting of 1 if the country was a host or a 0 if the country was not a host for that years Winter Olympic Games.
EFI	The Economic Freedom Index value.
FDI	Foreign Direct Invest as a percentage of GDP.

As shown in the table below, the variables we used for our analysis are GDP growth pre Olympics (preGDP), GDP growth post Olympics (postGDP), the Economic Freedom Index (EFI), foreign direct investment (FDI), government expenditures (govExp), and a dummy host variable. All data came from the World Bank except for the Economic Freedom Index, which came from the Fraser Institute. For our first independent variable preGDP, we took the GDP growth per capita for the four years preceding the subject Olympics and averaged them. Similarly, for our dependent variable postGDP, we used the average of the GDP per capita for the year of the Games as well as the following three years. The EFI was used to help explain post-Olympic growth as one would expect more economically free countries to have a higher growth rate. EFI scores range from 1 to 10 with 10 meaning that a country is completely economically free. Foreign Direct Investment was included as a percentage of GDP and was intended to help explain post GDP as it is a major contributor to a country's GDP. It was also included to give a sense of whether hosting an Olympics would create an influx foreign investment or not. Government expenditures were measured as a percentage of GDP and were included because of their major impact on GDP as well as for the possibility that host cities' GDP may have risen as a result of the government spending money on the necessary infrastructure. Finally, a dummy variable, Host, was used to denote which cities/countries hosting the Olympics with 1 indicating a host and 0 indicating a finalist.

In order for the data to be accurate, explanatory, and unbiased, the data must satisfy the Gauss Markov Assumptions. Our model satisfies assumption 1 because the models are linear in parameters. Assumption 2 states that the model must come from random sampling. This assumption is satisfied as we included all possible cities/countries in our model. Our model also satisfies the third assumption as our model has been tested for collinearity and none of our variables were determined to be perfectly collinear. The final assumptions are that the expected value of the error term is zero and the variance of the error term is constant given independent explanatory variables.

Table 1: Overall Descriptive Statistics

Variable	**Obs**	**Mean**	**Std. Dev**	**Min**	**Max**
postGDP	58	2.257	1.885	-1.457	8.359
preGDP	58	2.713	2.344	-5.489	10.853
EFI	59	7.350	0.812	4.68	8.65
FDI	54	2.426	2.336	0.003	11.431
govExp	58	18.202	3.84	10.554	26.661

Host	59	0.203	0.406	0	1

Table 2: Host Descriptive Statistics

Variable	**Obs**	**Mean**	**Std. Dev**	**Min**	**Max**
postGDP	**12**	**1.905**	**2.033**	**-1.238**	**4.784**
preGDP	**12**	**2.891**	**1.860**	**-0.314**	**5.977**
EFI	**12**	**7.334**	**0.765**	**6.04**	**8.42**
FDI	**12**	**1.094**	**1.170**	**0.003**	**4.029**
govExp	**12**	**17.969**	**3.333**	**12.779**	**22.744**

Table 3: Finalist Descriptive Statistics

Variable	**Obs**	**Mean**	**Std. Dev**	**Min**	**Max**
postGDP	**46**	**2.349**	**1.857**	**-1.457**	**8.359**
preGDP	**46**	**2.666**	**2.471**	**-5.489**	**10.854**
EFI	**47**	**7.354**	**0.832**	**4.68**	**8.65**
FDI	**43**	**2.767**	**2.445**	**0.088**	**11.431**
govExp	**46**	**18.262**	**3.993**	**10.554**	**26.661**

4. Results

(1) $postGDP = \beta_0 + \beta_1 preGDP + u$

The linear model analyzed the relationship that the pre-Olympic GDP growth had on the post-Olympic GDP growth. For *preGDP* the model yields a t = 5.48 with a p > |t| = 0.000. This indicates that *preGDP* is highly significant. The coefficient was positive indication that for every unit of preGDP, *postGDP* would increase.The R^2 value is equal to .3490 implying that *preGDP* explains about %34.90 of *postGDP*. These results are as expected.

(2) $\boldsymbol{postGDP = \beta_0 + \beta_1\, preGDP + \beta_2\, host + u}$

This model is a multilinear regression that takes into account whether or not a country hosted a Winter Olympic Game by using our dummy variable. In this model, *preGDP* yields a t = 5.35 with a p > |t| = 0.000, again implying that is it highly significant. The *host* shows that t = -1.11 and p > |t| = .272, making it insignificant in this model. Surprisingly the coefficient is -.5510, this is contrary to what was originally expected although the value is insignificant in this model. The R^2 value increased and came to .3632, showing that these two variables could explain about %36 percent of *postGDP* figures.This is a small increase, but again not as much as originally expected.

(3) $\boldsymbol{postGDP = \beta_0 + \beta_1\, preGDP + \beta_2\, host + \beta_3 EFI + \beta_4 FDI + u}$

In this model, *preGDP* is again significant at 1% with a positive coefficient. The coefficient of *host* is still negative, although slightly less being -.2689, and continues to be largely insignificant. *EFI* yields a t = -2.22 and p > |t| = .031, showing a significance at 5%. The coefficient of EFI is also surprisingly negative, something that was not predicted. *FDI* yields a t = .1665 and p > |t| =.095, making it significant at 10%. The R^2 value came to .3774, increasing by a small amount.

(4) $\boldsymbol{postGDP = \beta_0 + \beta_1\, preGDP + \beta_2\, host + \beta_3\, EFI + \beta_4\, FDI + \beta_5\, govExp + u}$

The last model explaining *postGDP* included *govExp* which had a t = -.0869 with p > |t| = .129 showing no notable significance. The R^2 value came to .4068, which is the highest of the R^2 values any model produced. The trend continued for *preGDP* being significant at 1% with a positive coefficient. Host continued to take on a negative coefficient as well as be largely insignificant. EFI and FDI are both more negative with the same significance as in the previous model.

(5) $\boldsymbol{host = \beta_0 + \beta_1\, postGDP + \beta_2\, FDI + \beta_3 govExp + u}$

Since the general trend showed that hosting an Olympic Games was not significant to a country's *postGDP*, in a small experiment the host variable was moved to become a dependant variable. Several different models were tested, but most were too insignificant. The best model we tested, Model 5, had the independent variables *postGDP, FDI,* and *govExp.* The results were interesting as the R^2 value was only able to reach .0911. *FDI* and *postGDP* both had negative coefficients, however *FDI* was significant at 5%. This implies that the foreign direct investment has an inverse relationship with hosting a Winter Olympic Games that should be noted. Though *govExp* had a positive coefficient it was insignificant.

(6) $\boldsymbol{postGDP = \beta_0 + \beta_1 preGDP + \beta_2 EFI + \beta_3 FDI + \beta_4 govExp + u}$

A Chow test was conducted on the model above. Model 6 was taken from Model 4, but removes the host as a variable. A multilinear regression was run on the equation above. In order to obtain the values for a Chow test, two more regressions were run with this same model, one on all of the hosts, and one on all of those that did not host. After retrieving the Stata output for each of the regressions the following formula was used to compute F-statistic:

$$\frac{[SSRp - (SSR1 + SSR2)]/(k+1)]}{(SSR1 + SSR2)/(n - 2(k+1))}$$

The null hypothesis states that there is no difference between hosting and not hosting a Winter Olympics. The result yielded an F-statistic of 1.114. This model is statistically significant at 1% and the null hypothesis cannot be rejected.

5. Conclusion

Our models consistently showed that the most significant factors in predicting a country's post Olympics GDP were pre-Olympic GDP and FDI, which interestingly did not appear to be correlated with hosting an Olympics. This lends credit to the theory that Olympic games yield no long term benefits for the hosts. However, the results of our analysis still remain relatively inconclusive. While our Chow test showed that the null hypothesis cannot be rejected, implying that there is no difference between hosting and not hosting a Winter Olympic games on a country's GDP, the low r-squared values on our models as well as the number of significant variables cast a shadow of doubt on this result. With that said, these results should still give pause to policymakers who are determining whether to bid on a Winter Olympic Games.

Dependent Variable: postGDP				
Independent Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
preGDP	.4749*** (5.48)	.4787*** (5.35)	.4846*** (5.06)	.4685*** (4.94)
host	--	-.5510 (-1.11)	-.2689 (-.50)	-.2399 (-.45)
EFI	--	--	-.5804** (-2.22)	-.6108** (-2.37)
FDI	--	--	.1665* (1.70)	-.1916* (1.96)
govExp	--	--	--	-.0869 (-1.54)
Intercept	.9688 (3.13)	1.07 (3.32)	4.8269 (2.59)	6.6329 (3.04)
Number of observations	58	58	54	54
R-Square	.3490	.3632	.3774	.4068

*** Significant at 1%, ** Significant at 5%,* Significant at 10%

Dependent Variable: host	
Independent Variables	**Model 5**
postGDP	-.0173 (-.57)
FDI	-.0496** (-2.07)
govExp	.0008 (.05)
Intercept	.3454 (1.51)
Number of observations	54
R-Square	.0911

*** Significant at 1%, ** Significant at 5%,* Significant at 10%

Notes

1. See http://www.businessinsider.com/why-sochi-is-by-far-the-most-expensive-olympics-ever-2014-1

References

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6. Appendix

A. Models Used

Models Used

$$(1)\ postGDP = \beta_0 + \beta_1 preGDP + u$$

$$(2)\ postGDP = \beta_0 + \beta_1 preGDP + \beta_2\ host + u$$

$$(3)\ postGDP = \beta_0 + \beta_1 preGDP + \beta_2\ host + \beta_3 EFI + \beta_4 FDI + u$$

$$(4)\ postGDP = \beta_0 + \beta_1 preGDP + \beta_2\ host + \beta_3\ EFI + \beta_4\ FDI + \beta_5 govExp + u$$

$$(5)\ host = \beta_0 + \beta_1 postGDP + \beta_2\ FDI + \beta_3 govExp + u$$

$$(6)\ postGDP = \beta_0 + \beta_1 preGDP + \beta_2\ EFI + \beta_3\ FDI + \beta_4 govExp + u$$

B. Stata Output

Model (1)

```
regress postGDP preGDP

      Source |       SS           df       MS      Number of obs   =        58
-------------+----------------------------------   F(1, 56)        =     30.02
       Model |  70.6385669         1  70.6385669   Prob > F        =    0.0000
    Residual |  131.791544        56  2.35342043   R-squared       =    0.3490
-------------+----------------------------------   Adj R-squared   =    0.3373
       Total |  202.430111        57  3.55140546   Root MSE        =    1.5341

------------------------------------------------------------------------------
     postGDP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      preGDP |   .4749103   .0866843     5.48   0.000     .3012608    .6485598
       _cons |   .9688398   .3096528     3.13   0.003     .3485307    1.589149
```

Model(2)

```
regress postGDP preGDP Host

      Source |       SS           df       MS      Number of obs   =        58
-------------+----------------------------------   F(2, 55)        =     15.69
       Model |  73.5236049         2  36.7618025   Prob > F        =    0.0000
    Residual |  128.906506        55  2.34375466   R-squared       =    0.3632
-------------+----------------------------------   Adj R-squared   =    0.3400
       Total |  202.430111        57  3.55140546   Root MSE        =    1.5309

------------------------------------------------------------------------------
     postGDP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      preGDP |   .4786759   .0865727     5.53   0.000     .3051804    .6521714
        Host |  -.5510033   .4966318    -1.11   0.272    -1.546276    .4442691
       _cons |   1.072624   .3228644     3.32   0.002     .4255896    1.719659
```

Model(3)

```
. regress postGDP preGDP Host EFI FDI
```

Source	SS	df	MS			
				Number of obs	=	54
				F(4, 49)	=	7.42
Model	68.4949033	4	17.1237258	Prob > F	=	0.0001
Residual	113.008591	49	2.30629777	R-squared	=	0.3774
				Adj R-squared	=	0.3265
Total	181.503494	53	3.42459423	Root MSE	=	1.5186

postGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
preGDP	.4846032	.0956807	5.06	0.000	.2923256	.6768808
Host	-.268955	.5400394	-0.50	0.621	-1.354205	.8162948
EFI	-.5804133	.2609347	-2.22	0.031	-1.104781	-.0560453
FDI	.1664574	.0979104	1.70	0.095	-.030301	.3632158
_cons	4.826852	1.86493	2.59	0.013	1.079135	8.574569

Model(4)

```
regress postGDP preGDP Host EFI FDI govExp
```

Source	SS	df	MS			
				Number of obs	=	54
				F(5, 48)	=	6.58
Model	73.8424999	5	14.7685	Prob > F	=	0.0001
Residual	107.660994	48	2.24293738	R-squared	=	0.4068
				Adj R-squared	=	0.3451
Total	181.503494	53	3.42459423	Root MSE	=	1.4976

postGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
preGDP	.4685684	.094927	4.94	0.000	.2777049	.6594319
Host	-.2399764	.5329001	-0.45	0.655	-1.311444	.8314911
EFI	-.6107732	.2580756	-2.37	0.022	-1.129669	-.0918775
FDI	.191552	.0979143	1.96	0.056	-.005318	.388422
govExp	-.0869057	.0562831	-1.54	0.129	-.2000704	.0262589
_cons	6.63287	2.179556	3.04	0.004	2.250578	11.01516

Model(5)

```
. regress Host postGDP FDI govExp
```

Source	SS	df	MS			
Model	.798343166	3	.266114389	Number of obs	=	54
Residual	7.96091609	50	.159218322	F(3, 50)	=	1.67
				Prob > F	=	0.1850
Total	8.75925926	53	.165269043	R-squared	=	0.0911
				Adj R-squared	=	0.0366
				Root MSE	=	.39902

Host	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
postGDP	-.017263	.0304697	-0.57	0.574	-.0784632	.0439373
FDI	-.0496397	.0239701	-2.07	0.044	-.0977851	-.0014943
govExp	.000819	.0152103	0.05	0.957	-.0297318	.0313697
_cons	.3454126	.3011961	1.15	0.257	-.2595575	.9503827

Model(6) -- Chow Test

```
. regress postGDP preGDP EFI FDI govExp
```

Source	SS	df	MS			
Model	73.3876557	4	18.3469139	Number of obs	=	54
Residual	108.115838	49	2.20644568	F(4, 49)	=	8.32
				Prob > F	=	0.0000
Total	181.503494	53	3.42459423	R-squared	=	0.4043
				Adj R-squared	=	0.3557
				Root MSE	=	1.4854

postGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
preGDP	.4687132	.0941511	4.98	0.000	.2795095	.6579169
EFI	-.6245961	.2541506	-2.46	0.018	-1.135331	-.1138614
FDI	.2051717	.0923656	2.22	0.031	.0195561	.3907872
govExp	-.0877983	.0557887	-1.57	0.122	-.1999099	.0243133
_cons	6.66871	2.160312	3.09	0.003	2.327401	11.01002

```
regress postGDP preGDP EFI FDI govExp if Host==0
```

Source	SS	df	MS
Model	55.1203673	4	13.7800918
Residual	83.0190065	38	2.1847107
Total	138.139374	42	3.28903271

Number of obs	=	43
F(4, 38)	=	6.31
Prob > F	=	0.0005
R-squared	=	0.3990
Adj R-squared	=	0.3358
Root MSE	=	1.4781

postGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
preGDP	.4597795	.0997517	4.61	0.000	.2578428	.6617163
EFI	-.5035919	.2790069	-1.80	0.079	-1.068412	.061228
FDI	.1494876	.0983891	1.52	0.137	-.0496908	.3486661
govExp	-.0863401	.0593712	-1.45	0.154	-.2065309	.0338506
_cons	5.974041	2.345609	2.55	0.015	1.225603	10.72248

```
regress postGDP preGDP EFI FDI govExp if Host==1
```

Source	SS	df	MS
Model	28.4025902	4	7.10064754
Residual	12.9465439	6	2.15775732
Total	41.3491341	10	4.13491341

Number of obs	=	11
F(4, 6)	=	3.29
Prob > F	=	0.0939
R-squared	=	0.6869
Adj R-squared	=	0.4782
Root MSE	=	1.4689

postGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
preGDP	.7309946	.362343	2.02	0.090	-.1556268	1.617616
EFI	-1.455838	.6870976	-2.12	0.078	-3.137105	.225429
FDI	1.395033	.5580295	2.50	0.047	.0295841	2.760482
govExp	-.1988473	.1837648	-1.08	0.321	-.6485036	.2508089
_cons	12.69326	6.791886	1.87	0.111	-3.925885	29.31241

C. Countries Used (see above table)

Country Data Used for Each Winter Games			
1964 **Austria** Canada Finland	1968 Canada Finland **France** Japan Norway United States	1972 Canada Finland **Japan** United States	1976 **Austria** Canada Finland Switzerland United States
1980 Canada **United States**	1988 **Canada** Italy Sweden	1992 Bulgaria **France** Germany Italy Norway Sweden United States	1994 Bulgaria **Norway** Sweden United States
1998 Canada Italy **Japan** Spain Sweden United States	2002 Austria Canada Italy Slovakia Spain Sweden Switzerland Russia **United States**	2006 Austria Finland **Italy** Poland Slovakia Switzerland	2010 Austria Bosnia **Canada** China Slovakia Spain Switzerland